CLAIMS

1. A multi-well assay plate structure comprising:

a first upper surface,

a second lower surface having a plurality of wells disposed therein,

the first and second surfaces defining a chamber having an inlet and an outlet, the inlet and outlet allowing fluid to be introduced and withdrawn from the chamber, the wells being proportioned and dimensioned to retain a volume of fluid in each well following withdrawal of the liquid.

2. An assay plate structure as claimed in claim 1 wherein the chamber is shallow enough to allow fluid to fill the wells and the chamber.

3. ~~As~~ An assay plate structure as claimed in claim 1 ~~or 2~~ wherein the wells are deep enough to retain a volume of fluid following withdrawal of fluid in the space above the wells.

4. ~~As~~ An assay plate structure as claimed in ~~any preceding claim~~ claim 1 wherein the plate structure is sector-shaped with a handle at the longer arc-portion to facilitate locating the sector on a disc.

5. An assay plate structure as claimed in claim 4 wherein a plurality of sector-shaped plate structures are carried by a disc.

6. An assay plate structure as claimed in claim 5 wherein also the sectors and discs are made of plastic and the sectors can be snap-fitted onto the disc.

7. An assay plate structure as claimed in claim 5 ~~or 6~~ wherein the sectors and the disc include lock and key portions to allow the sectors to be snap-fitted in the correct orientation only.

8. ~~As~~ An assay plate structure as claimed in ~~any one of claims 1 to 4~~ claim 1 wherein the assay plate structure is a disc moulded in one piece with a plurality of wells.

9. An assay plate structure as claimed in claim 8 wherein the structure includes an upper disc with a plurality of

hinged sectors for allowing the sector to pivot from and return to the plane of the disc to facilitate the insertion and removal of assay plates in the sector space.

10. An assay plate structure as claimed in ~~any preceding claim~~ Claim 1 wherein the disk structure has a circumferential gutter extending around its periphery to facilitate collection of fluid following fluid withdrawal from the chamber.

11. An assay plate structure as claimed in ~~any preceding claim~~ Claim 1 wherein the plate structure and sector inserts are made of optically transmissive plastic.

12. A multi-well assay structure comprising an upper surface and a lower closely spaced opposed surface, said upper and lower surfaces defining a relatively shallow space therebetween, the lower surface having a plurality of wells therein, at least two spaced apart openings providing access to said space from an external location, wherein a fluid introduced into said space through one of said openings substantially fills the space and covers all of the wells and said fluid when subsequently withdrawn through the same or the other opening leaves the wells substantially filled with liquid.

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13. An assay plate structure as claimed in claim 12 wherein the spacing between said upper and lower surfaces is sufficiently small to facilitate the flow of fluid in said space by capillary or capillary like action.

14. An assay plate structure as claimed in claim 13 wherein the spacing is less than 1mm.

15. An assay plate structure as claimed in claim 14 wherein the spacing is less than 0.5mm.

16. An assay plate structure as claimed in ~~claims 13, 14 or 15~~ Claim 13 wherein the surfaces are provided by respective upper and lower plates which are spaced apart by one or more spacer walls.

17. An assay plate structure as claimed in ~~any one of claims 13 to 16~~ Claim 13 wherein the opening through which fluid is introduced into said space is provided through either the

upper or lower surface.

18. An assay plate structure as claimed in claim 17 wherein the opening is provided through the upper surface.

19. An assay plate structure as claimed in ~~any one of claims 13 to 18~~ claim 13 wherein said opening for introducing a fluid comprises a relatively small opening arranged to receive the end of a syringe or similar liquid injecting device, where the opening forms a substantially air-tight seal around said end.

20. An assay plate structure as claimed in ~~any one of claims 13 to 19~~ claim 13 wherein the underside of said upper surface of the container and the upper surface of the plate are treated to increase the hydrophobicity of such surfaces.

21. An assay plate structure as claimed in ~~any one of claims 12 to 20~~ claim 12 wherein the multi-well structure is a disk which comprises upper and lower circular plates, the internal surfaces of which respectively define said upper and lower opposed surfaces.

22. An assay plate structure as claimed in claim 21 wherein the second opening is provided at the peripheral edge of the disc.

23. An assay plate structure as claimed in claim 21 ~~or 22~~ wherein the space between the upper and lower plates is subdivided, by one or more dividing walls, to provide a plurality of multi-well plates in which case each space is provided with an opening and a vent to enable each space to be independently filled.

24. An assay plate structure as claimed in claim 23 wherein the dividing walls are radially extending.

25. An assay plate structure as claimed in ~~any one of claims 21 to 24~~ claim 21 wherein at least one of the upper and lower plates forming the structure are transparent to enable optical inspection of the wells from outside the structure.

26. An assay plate structure as claimed in claim 24 wherein the other of the upper and lower plates may comprise a reflecting surface so that radiation entering into the structure through the transparent plate

transverses the structure in both directions for providing improved signal detection.

27. An assay plate structure as claimed in ~~any one of claims 12 to 20~~ claim 12 wherein there is provided a disc arranged to receive a plurality of sector-shaped inserts each of which comprises a generally planar upper surface having a plurality of wells provided therein, the disk having, for each insert, a substantially planar surface arranged, in use, to oppose said substantially planar insert surface and means for retaining the insert in position so that the respective planar surfaces are in a closely spaced arrangement to one another, and to said at least two openings.

28. An assay plate structure as claimed in claim 27 wherein the opening for filling the space is provided through the planar surface of the disc.

29. An assay plate structure as claimed in claim 27 ~~or 28~~ wherein the vent opening is provided at, or adjacent to, the peripheral edge of the disc.

30. An assay plate structure as claimed in ~~claims 27 to 29~~ claim 27 wherein the disc comprises upper and lower circular plates separated by radially extending spacers.

31. An assay plate structure as claimed in claim 30 wherein said planar surface of each insert comprises upstanding walls around at least a portion of its periphery for the purpose of sealing the inner edges of the insert to the opposed planar surface of the disc, thereby to prevent seepage of liquid around the insert.

32. A method of filling the wells of the multi-well structure of the above first aspect of the present invention, said method comprising the steps of:

introducing a fluid into said chamber through one of said openings to substantially flood the chamber;

and subsequently withdrawing the fluid from the chamber through the same or the other opening to leave liquid in the wells.

33. A method as claimed in claim 8 wherein the method

further includes the step of forming an air tight seal between the fluid inlet and an end region of a syringe or similar liquid injecting device, and injecting fluid through the opening into the chamber and subsequently sucking liquid out of the space through the opening.

34. A method conducting a chemical or biochemical assay said method comprising the steps of:

providing a surface within a substantially enclosed chamber having a plurality of wells at spaced locations sufficient to allow monitoring of a reaction at each well location,

treating each well with a first reagent, flooding the enclosed chamber and covering the wells with a fluid carrying at least a second reagent,

removing excess fluid from said chamber to leave a mixture of said first and second reagents in each well, and

optically assessing each well and determining if a reaction occurred and correlating the reaction results to provide an assay of the chemical or biochemical reactions under test.

35. A method as claimed in claim 34 wherein the step of optical assessment is carried out automatically using optical reading apparatus.

36. A method as claimed in claim 34 ~~or 35~~ wherein the surfaces with wells having the first fluid carrying reagents are prior prepared for loading into the structure.

37. A method as claimed in ~~any one of claims 34 to 36~~ claim 34 wherein after optical assessment of the results of the assay, the automated fluid handling apparatus is used to inject and withdraw rinsing fluid a predetermined number of times from the well tray to clean the wells for receiving subsequent samples for assay.

38. Chemical/biochemical assay apparatus comprising an assay plate structure defined in said first aspect and having a plurality of wells for receiving samples to be assayed,

fluid handling means for introducing and removing

fluid reagents into said assay plate structure to allow a fluid reagent mixture to be retained in each well, and

optical assessment means for measuring optical result of the reaction in each well.

39. An assay plate structure for use in conducting optical assays of a fluid analyte, the plate structure comprising:

a disc for rotation about a central axis, the disc having upper and lower plates and a plurality of substantially radially extending walls disposed between the plate, wherein said walls sub-divide the disc into a plurality of disc sectors; and

a plurality of disc inserts arranged to be received by respective disk sectors and to be retained therein,

the structure further a plurality of openings through the upper surface, at least one opening above each disc sector for introducing a liquid analyte into the sector space between the plate and the disc insert.

40. An assay plate structure as claimed in claim 39 wherein the disc further comprises a lower plate, spaced apart from said upper plate by said radially extending walls.

41. An assay plate structure as claimed in claim 40 wherein the upper surface of each disc insert and the opposed surface of the plate are substantially planar.

42. An assay plate structure as claimed in ~~any one of claims 39 to 41~~ Claim 39 wherein a vent opening is provided for each disc segment around the periphery thereof, between the radially outer edge of the upper plate and each disc insert.

43. A multi-sample assay plate structure comprising:

a first upper surface,

a second lower surface spaced from the upper surface by wall means to define a chamber with the upper and lower surfaces spaced a preset distance apart,

the chamber having an inlet and an outlet, the inlet and outlet allowing fluid to be introduced to, and withdrawn from, the chamber, the lower surface being

adapted to receive spots of an insoluble substrate, carrying a first reagent, or no reagent if a control spot, to create a plurality of separate reaction sites, such at least a reagent is present in the fluid for reacting with the first reagent to create an observable reaction in the chamber.

44. A method of conducting an assay using the structure of claim 43 including the steps of,

disposing a plurality of spots of an insoluble substrate on said lower surface a predetermined distance apart to create a plurality of reaction sites, said spots carrying a first reagent, or none if a control spot,

flooding the chamber with fluid carrying at least one second reagent, withdrawing the fluid from the chamber to leave sufficient spots of fluid in contact with the substrate spots, and

optically monitoring each spot location to detect a reaction.